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Factsheet

FUSARIUM YELLOWS OF CELERY

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INTRODUCTION

Fusarium yellows of celery is caused by a soil-borne fungus called *Fusarium oxysporum* f.sp. *apii* which causes disease symptoms only on celery and which may result in serious yield and quality losses in infested fields. Historically, this disease caused extensive losses to celery growers from about 1920 until the late 1950s when a resistant celery cultivar, Tall Utah 52-70, was introduced. Many of the subsequent resistant cultivars were descendents of Tall Utah 52-70 and the disease was no longer a threat until a new race of the fungus appeared in California in the 1970s. Since then, race 2 of *Fusarium oxysporum* f.sp. *apii* has been reported in Michigan, New York, Texas, and in 1988, it was first observed in Bradford, Ontario.

SYMPTOMS

The fungus infects the plants through the root system. The severity of the disease in the field is closely associated with the degree of infection of the plants. Early infection, such as at time of sowing or transplanting, often leads to more severe yield and quality losses than infection later in the season near the time of harvest. Other factors, such as the soil population levels of the spores, and the weather during the growing season are also important. For example, as the population of these spores increases in the soil, more severe symptoms develop, while the disease appears most severe during warm seasons, and on heavy wet, soils.

Symptoms due to mild or late infections consist of slight stunting, a stiffening of the outer stalks or petioles, and a brown discoloration of the vascular system where water and food materials are transported. The leaves generally become more brittle, with a rougher texture, and curl upward. In severe infection, the outer leaves become yellow first (Figure 1) and the yellowing spreads to other leaves as the disease progresses through the vascular system of the roots and crown. In later stages of disease development, the foliage turns brown and dies (Figure 2). Also, there is extensive reddish-brown discoloration of the crown and vascular system of the roots and stalks (Figure 3), and plants are severely stunted (Figure 4). The internal crown discoloration may be seen by making a vertical cut through the centre of the upright plant (Figure 5). Bacteria and

Figure 2. Foliage turns brown and dies at later stages of disease development.

Figure 1. Yellowing of outer celery leaves following infection of roots by Fusarium oxysporum f.sp. apii.

Figure 3. Reddish-brown discoloration of the vascular system in the affected crown.

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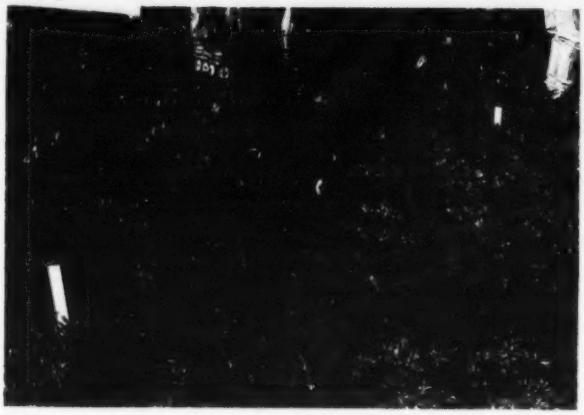

Figure 4. Diseased, susceptible, plants showing extreme stunting on the right. Compare with tolerant plants on the left.

other microorganisms often invade the affected crown and root tissues and cause secondary rot to develop. Death of the plant may occur in the final stages of disease development (Figure 6).

Figure 5. Vertical cut through the centre of an upright plant showing the internal reddish-brown discoloration of the diseased crown.

Figure 6. Final stage of disease development — death of the plant.

DISAESE SPREAD

The distribution of plants with symptoms in affected fields may appear to be patchy since not all plants are affected with the same severity. The fungus is spread when infested soil is carried from affected fields to disease-free fields by farm equipment such as on tractor tires or other farm implements, or on the shoes of field workers. It may be introduced also by use of infested seedling transplants. The fungal spores may be disseminated short distances when flood water containing soilborne spores moves from the higher parts of an infested portion of the field to the lower sections of the disease-free part of the field. Long distance dissemination occurs by windblown soil containing the fungus inoculum.

SOURCES OF INFECTION AND OVERWINTERING

The fungus persists in soil for many years as dormant spores in the absence of celery, or by colonizing the roots and stems of nonsusceptible host such as sweet corn, cabbage, and especially carrots. The roots of many weeds such as lamb's-quarters, smartweed, barnyard grass, and purslane are colonized also, but remain symptomless and allow the fungus to multiply, thereby increasing the population in the soil in the absence of the celery crop. Thus, short-term fallowing of infested fields is not an effective control measure, and research has demonstrated that even low spore populations in the soil may cause crop failures at harvest. Spore populations of the fungus increase quickly if susceptible celery cultivars or carrots are grown in infested fields. Continuous celery production, and incorporation of celery trimmings back into the soil at harvest will greatly increase spore populations and enhance disease development in the subsequent celery crop since the discarded celery material serves as a food source for the fungus. Rotation with onions or lettuce prevents spore populations in soil from increasing as quickly as with the susceptible celery crop so that after 2 or 3 years moderately resistant celery cultivars may be re-introduced into infested fields and disease severity reduced.

CONTROL

1. Use of cultivars that are either resistant (eg. Starlet) or tolerant (eg. Tall Utah 52-70 HK strain, Deacon) is the most satisfactory means of control in infested fields. Tolerant cultivars will yield well in fields with

light to moderate soil infestations of *Fusarium oxysporum* f.sp. *apii* race 2, however, yield loses will occur in severely infested soils. Other cultivars, such as Tendercrisp, are moderately tolerant. Resistant or tolerant cultivars should be grown in infested fields. Use of susceptible cultivars such as Florida 683 or Utah 52-70 in infested fields will result in significant yield and quality losses and will also worsen the disease situation in future years by increasing spore populations of the fungus in the soil. Consult OMAF Publication 363, *Vegetable Production Recommendations* and the local extension specialist for current cultivar recommendations.

2. Do not return celery trimmings to infested fields after harvest since the fungus can increase on celery residues.
3. Practice a 2 to 3-year rotation with onions or lettuce to reduce spore populations in infested fields. This will be more effective if the rotations are begun before the problem becomes serious. Avoid the use of carrots and sweet corn in the rotation sceme since they allow the fungus to multiply in the root zone.
4. Control weeds which also may allow the fungus to multiply in the root zone.
5. Prevent introduction of Fusarium yellows on transplants by practicing sanitation in the greenhouse. Steam or fumigate soil and flats annually before seeding. Disinfect work benches and surfaces before seeding. Use a disease-free commercial potting mix or soil that has been steamed or fumigated. Follow the recommendations for cleanliness and sanitation, bench and equipment sterilization, and soil pasteurization in OMAF Publication 365, *Pesticide Recommendations for Greenhouse Crops.*
6. Avoid buying field-grown transplants from areas where Fusarium yellows has been reported. Use of infected transplants will contribute significantly to dissemination of the fungus to fields where the disease has not been reported previously.
7. Prepare non-infested fields first before entering infested fields with machinery to avoid introduction of infested soil on tractor tires and implements, and on shoes to non-infested fields. Exercise caution in allowing machinery or people into infested fields if equipment has not been steam-cleaned or washed thoroughly with hot water afterwards. Soil washed from machinery should be collected and disposed of. Do not borrow machinery from areas where Fusarium yellows is present or suspected. Also, if possible or practical, limit or prevent the movement of flood water from infested fields to non-infested fields.
8. Containers, such as pallet boxes, used for packing celery where Fusarium yellows has been reported, should be washed with hot water or disinfested before being used by other growers who do not have the problem. A commercial disinfectant such as chloride bleach at a concentration of 1 part 5% bleach in 10 parts water may be used. Traces of bleach may be removed by washing crates or containers with water afterwards.
9. Chemical control of Fusarium yellows using fungicidal drenches at the time of transplanting or later has been unsuccessful. Also, although fumigation of seedbeds initially may be successful, complete prevention of the pathogen is difficult because it involves frequent cleaning of equipment and control of windblown muck soil.

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